

# Guidance on metrological requirements for Electrical Vehicles Charging Systems

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## 1. Introduction

Mobility and transport are essential for economy as a whole. Free movement of people and goods is a fundamental freedom of the European single market. Mobility brings many socio-economic benefits to the European public and businesses, but also has a growing impact on the environment, including in the form of increased greenhouse gas emissions and local air pollution, which affect human health and well-being.

Meeting the European Green Deal's transport emission reduction objectives requires a substantial increase in zero- and low-emission vehicles and vessels. A prerequisite for this desired and ongoing development is the deployment of a coherent and complete network of fully interoperable alternative fuels infrastructure that enables people to travel in alternative fuel vehicles such as electric vehicles. To realise this, it is equally important that the manufacturers of the components constituting the infrastructure faces an as harmonised legal framework as possible.

There is currently a substantial increase in the use of electric vehicles. Electric vehicle charging stations (EVCS) are installed all over the area of the single market. For delivery of conventional fuels, such as petrol and diesel, the infrastructure used, i.e., fuel dispensers, is covered by harmonised legal metrology regulations ensuring the consumer trust and confidence in the measurements and transactions. A corresponding clear legal framework is missing for the charging of EVs in many countries mainly due to the lack of a harmonised requirements on the EVCS as such. Nevertheless, it is important that trust and confidence in measurements is maintained even when charging vehicles. The market, consumers, charge point operators and manufacturers, expects a legal metrology framework to be established in the near future to ensure trust and confidence in the measurements as well as a level playing field.

This guide is developed by legal metrology authorities and bodies in Denmark, Finland, Norway, Sweden and Switzerland. It gives guidance related to legal metrology requirements only and is intended for manufacturers, importers and distributors of charging stations products intended for charging electrical vehicles. The purpose of the guide is to obtain a harmonised approach regarding the metrological aspects of an EVCS to ensure that products to be placed on the market meet common metrological requirements. This is obtained by using legal elements in already existing harmonised legal acts and standards. In addition, there are other legal requirements such as electrical safety directive (LVD), electromagnetic compatibility directive (EMCD) and legislation on consumer protection that need to be considered when applicable. This guide applies also to charge point operators. The purpose is to ensure that charge point operators maintain the metrological stability of charging stations in use.

## 2. Scope

This guide applies when manufacturers and importers are placing the product electric vehicle charging station (EVCS) on the market. In addition, this guide applies to charge point operators regarding EVCS in use.

Any guidelines or regulation for taking the charging stations into use is a matter of the individual country.

This guide applies only for the case where the charging station is used for billing the consumer or end-user for the specified amount of electrical energy in watt hours (Wh).

### 3. Legislative background

The measuring instruments directive (2014/32/EU – MID<sup>1</sup>) covers requirements for a number of different measuring instruments. Originally, the focus of the directive was to cover electric energy metering in utility applications only. However, an EVCS as such is not by default considered a measuring instrument in that sense, and hence, not covered by the MID or any other piece of legislation regarding metrological requirements. In the absence of a clear interpretation of the harmonised legislation for the single market, there are no distinct metrological requirements for a manufacturer of EVCS. For these reasons, European countries may define national requirements without reference to MID. Different requirements in countries will then hinder the free movement of such products on the single market.

This guide is a supplement to the existing legal framework in order to cover metrological requirements on EVCS to be placed on the market.

### 4. Definitions

This guide refers to definitions in MID. In addition, the following definitions apply.

- **EVCS** – Electrical Vehicle Charging Stations
- **Delivery point** – Interface in which the electrical energy is delivered
- **Current range** – Range from  $I_{\min}$  to  $I_{\max}$
- **Voltage range** – Range from  $U_{\min}$  to  $U_{\max}$
- **Reference conditions** – Defined in the directive 2014/32/EU
- **Manufacturer** – The manufacturer is any natural or legal person who manufactures an EVCS or has an EVCS designed or manufactured, and places it on the market under his own name or trademark.
- **Importer** – any natural or legal person established within the market who places a EVCS on the market from a country outside the area where this guide applies.
- **Charge point operator** - responsible for the management and operation of a charging point, which provides a charging service to consumers or end users.

### 5. Description of EVCS – Electrical Vehicle Charging Station

An EVCS is a product placed on the market by a manufacturer or an importer. The concept of the EVCS from a legal metrology perspective is defined within the red dashed line in the figure below. The metrologically relevant functions are:

- metering function,
- delivery point and
- user interface for indication of measurement results.

The metering function is illustrated as being within the green dashed line and can for example a standalone electrical energy meter or an integrated metering function.

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<sup>1</sup> DIRECTIVE 2014/32/EU on the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments

The delivery point is the electrical interface in which the energy is delivered and the measurement result refers to. If the manufacturer has fitted the EVCS with a cable, the delivery point of the transferred electrical energy is at the end of the cable connected to the vehicle being charged. If the EVCS is designed in such a way that the consumer or end-user has to bring their own cable, the delivery point is where the cable is connected to the EVCS. For inductive charging, the delivery point is on the EVCS where the transferred energy to the vehicle is leaving the EVCS. The physical interface of the delivery point can be a standardised connector or an inductive charger or similar.

The user interface provides the indication of measurement result of the energy transferred through the delivery point. This interface shall at least fulfil the draft regulation on the deployment of alternative fuels infrastructure<sup>2</sup>.

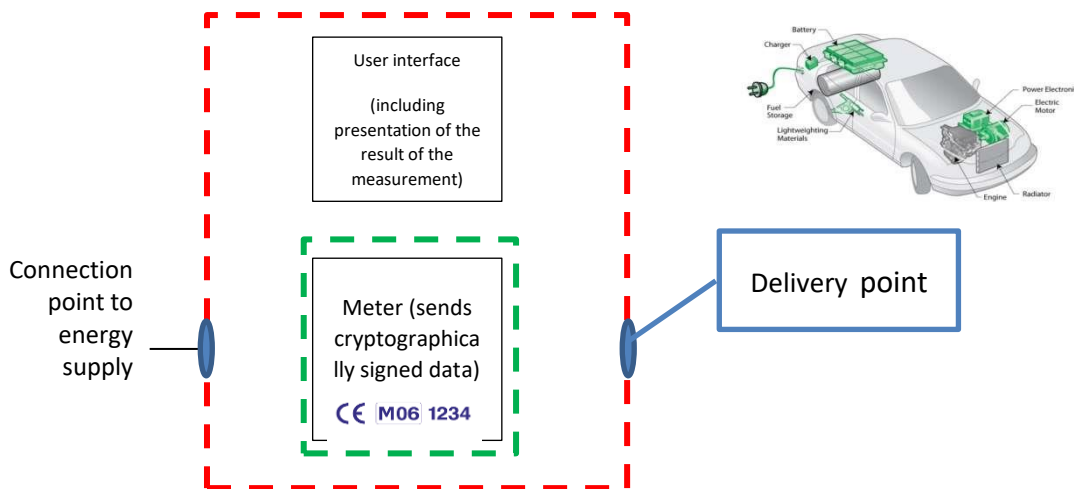


Figure. The figure shows an EVCS with a standalone meter.

## 6. Metrological requirements on EVCS

### 6.1. MPE at the delivery point

The error of measurement at the delivery point and reference conditions shall not exceed the maximum permissible error (MPE) value of the meter plus 1/6 MPE at reference conditions.

### 6.2. Metering function

The electrical energy metering function shall fulfil the following requirements

- for AC application – assessed and approved according to MID 2014/32/EU,
- for DC application – assessed and approved according to MID 2014/32/EU (if possible) or fulfilling the requirements of the provisional EURAMET standard<sup>2</sup> on energy meters for DC applications,
- suited for outdoor installation (climatic environment from -25 °C or -40 °C to +55 °C or +70 °C depending on geographical location and design of EVCS),
- measurement performance as a Class B meter or better and
- if a standalone meter is used, it must be installed according to the meter manual.

<sup>2</sup> Requirements for active electrical energy meters for DC applications, <https://www.metas.ch/legalevcharge>

### **6.3. Indication of result**

The reading of the measurement result serves as the basis for the price to pay.

The indication of the measurement result shall be transparent, trustworthy and non-discriminatory and by means of, for instance, a

- physical display on the charging station,
- hard copy,
- soft copy,
- app or
- other solutions.

An EVCS shall record by a durable means the measurement result accompanied by information to identify the particular transaction. Durable proof of the measurement result and the information to identify the transaction shall be available on request at the time the measurement is concluded.

The resolution of the indication of result shall be suitable for the purpose. In cases where various devices provide indications of the result, they shall all have the same resolution. If this resolution is too fine to be convenient for the consumer or end-user, truncation may be implemented for convenience. However, only the indication of result provided by the metering function is legally relevant. This indication shall always be available to all parties involved in the transaction<sup>3</sup>.

### **6.4. Securing**

The following shall be adequately protected against accidental or intentional corruption

- measurement result and the information to identify the particular transaction,
- software that is critical for measurement characteristics and
- metrological important parameters stored or transmitted.

A hardware component that is critical for metrological characteristics shall be designed so that it can be secured. Security measures foreseen shall provide for evidence of an intervention. Software that is critical for metrological characteristics shall be identified as such and shall be secured.

### **6.5. Suitability**

A charging station shall be designed to allow the metrological control of the measuring tasks after the instrument has been placed on the market and put into use. If necessary, special equipment or software for this control shall be part of the instrument. The test procedure shall be documented.

The metering function shall work within the limits of voltage range and current range for the meter. It shall not be possible for the control system to operate during undercut or exceed of those limits during recharging of the vehicle.

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<sup>3</sup> Example: The metering function provides the indication of result with a resolution of 1 mWh, allowing for easy testing without a dedicated test mode. When a test mode is available, a test would be necessary to confirm that the characteristics in test mode correspond to those in normal use, which takes time. At a price of 0.30 €/kWh, 1 mWh is worth  $0.30 \times 10^{-6}$  €. Such a resolution is of no use to the consumer. Therefore, the result is rounded to a resolution of 0.1 kWh (0.03 €). The consumer is shown the metrologically relevant data as it is provided by the metering function, including the cryptographic signature if applicable, at a single touch of a button.

## 7. Conformity assessment

Conformity assessment in this guide refers to the metrological relevant aspects of the EVCS not covered by MID, and sets up some additional requirements for marking beside the mandatory CE-marking needed due to other applicable legal acts.

As mentioned above a clear metrological legal framework is missing on the EVCS as such. Nevertheless, the manufacturer and indeed the charge point operators need to be able to show to consumer or end-users, competitors and legal metrology authorities in a transparent and confident way that the indication of results of the measurement result at the delivery point can be trusted. Depending on the design of the EVCS, be it an integrated metering function or standalone meter, the metrologically relevant functions are covered by the MID conformity assessment to a greater or lesser extent. The manufacturer has to account for the requirements falling outside of the MID scope. The most convenient and transparent way for all parties is that the compliance is shown and documented in a beforehand defined format such as a product declaration.

### 7.1. Product declaration

The product declaration shall state that the requirements set out in this guide are fulfilled. All metrologically relevant parts not covered by MID shall be described in the declaration and it shall cover

- the construction including any losses between the metering function and the delivery point<sup>4</sup>,
- manufacture and operation and
- securing of the EVCS according to 6.4 above including an adequate analysis and assessment of the risks.

## 8. Obligations for manufacturers

Before placing compliant EVCS on the market, the manufacturers of EVCS have to

1. prepare the product declaration,
2. indicate on the EVCS the year of manufacturing, the type, batch or serial number or other elements allowing to uniquely identify the EVCS,
3. when a stand-alone meter is used, make sure that the information needed to uniquely identify the meter is visible on the EVCS,
4. indicate on the EVCS their name, registered trade name or registered trade mark and contact information at which they can be contacted where the contact details shall be in a language easily understood by end-users,
5. indicate on the EVCS the voltage range, current range, nominal frequency and if applicable, temperature range, accuracy class, national approval mark and
6. ensure that the EVCS is accompanied by instructions and information in a language which can be easily understood by end-users, as determined by the country concerned. Instructions shall include installation, maintenance, metrological control, repairs, permissible adjustments and correct operation and any special conditions of use.

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<sup>4</sup> For instance, if the EVCS includes a cable, the instructions shall include information about the correction for cable losses, namely whether the cable losses are corrected for mathematically or whether the four-point technique is used, and specify which cables may be used.

## 9. Obligations for importers

Before placing compliant EVCS on the market, the importers of EVCS have to

1. be able to obtain the product declaration drawn up by the manufacturer,
2. indicate on the EVCS their name, registered trade name or registered trade mark and contact information at which they can be contacted where the contact details shall be in a language easily understood by end-users and
3. ensure that the EVCS is accompanied by instructions and information, in a language which can be easily understood by end-users, as determined by the country concerned. Instructions shall include installation, maintenance, metrological control, repairs, permissible adjustments and correct operation and any special conditions of use.

## 10. Obligations for charge point operators

The charge point operators have to

1. use only compliant EVCS on the market,
2. ensure that the EVCS is suited for the operating conditions,
3. provide information on the EVCS visible to the consumer or end-user to enable unique identification of the EVCS, the delivery point and the charge point operator,
4. ensure that the EVCS is properly installed, maintained, repaired, and operated according to the instructions of the manufacturer and importer,
5. ensure to comply with national regulations for MPE and in use verification<sup>5</sup>,
6. provide the necessary tools to access the metering function in case of subsequent verification and
7. fulfil the obligations in any other national regulation that may apply.

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<sup>5</sup> National regulations may require the operator to establish a self-monitoring system and may require subsequent verification. Depending on the national regulations, changing the cable may require a notification and a subsequent verification, especially when cable losses are corrected for mathematically.